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TROUT IN FIJI.

In November, 1919, Mr. E. T. Francis, of Savusavu, who has had many years experience of trout culture in America, suggested to the Government that the introduction of trout into the hill streams of Fiji might be effected by obtaining ova packed in ice and moss from New Zealand, and hatching the ova in Fiji near the stream selected for liberation of the fry. The advice of the New Zealand Fishery Authorities was sought, and, after the temperature of the streams had been communicated to them, they decided that an experiment with ova in Fiji might have reasonable prospects of success. They undertook to supply ova, and, before despatch to Fiji, to inform this Government as to details as regards hatching boxes and procedure, in sufficient time to make the necessary arrangements for transport of the ova to Nadarivatu from Suva, and for preparations to be made for hatching.

Unfortunately, owing to the Department in New Zealand who were making arrangements on behalf of the Fiji Government not receiving information from the hatchery that the ova were ready, the ova were despatched independently by the latter and unexpectedly arrived in Suva by the s.s. "Tahiti" on the 3rd August, without any instructions having been received. They were immediately placed in the cool-room at Messrs. Sunderland & Co., and instructions were invited by telegram from New Zealand. Telegraphic instructions were received on the 10th, hatching boxes were hastily constructed, and the ova were despatched to Lautoka by the s.s. "Mokoia" on the 13th, where the District Commissioner, Nadarivatu, would meet them and convey them as rapidly as possible by motor car to Nadarivatu. The fates seemed to have combined to defeat the success of the experiment. Torrents of rain fell at Lautoka and the road became impassable for motor traffic. The District Commissioner arranged hurriedly with the Colonial Sugar Refining Company for the ova to be transported to Nadarivatu on their tramline to Tavua, and thence to be carried by natives. Instead of one day being occupied on the journey, it was two and a half days before the ova arrived at Nadarivatu, having experienced en route every kind of jolting and rough handling possible. To save time the hatching boxes were placed under pipe-borne water, and the risk taken that the temperature of this water, owing to the exposure of the pipes to the sun, might prove to be too high for the purpose of hatching.

Under conditions such as these it was doubtful whether any ova would be still alive, and the fact that any at all hatched out is a tribute to the strength of their constitutions.

On the day after their arrival at Nadarivatu the District Commissioner telephoned to Suva that some ova were already hatching out. A telegram was despatched to Mr. E. T. Francis, who had generously offered to superintend a hatching experiment for his out of pocket expenses, and he proceeded without delay to Nadarivatu.

Several dozen fish hatched out in spite of the adverse conditions due to delay in Suva and on the journey, and thrived sufficiently to be liberated by Mr. Francis in a suitable stream. Mr. Francis made a careful examination of the streams in the vicinity of Nadarivatu, and has informed the Government that, in his opinion, conditions are favourable for acclimatisation of trout, and that a further experiment, under better conditions, would be

assured of success. The natural food supply in the Nadarivatu streams he reports to be ample.

Owing to the lateness of the season it is impracticable to procure a further supply of ova from New Zealand this year. A further experiment will, if possible, be made next July, and the New Zealand Authorities have been asked whether they will be in a position to provide 50,000 ova to send to Fiji. Mr. Francis recommends that the experiment be made with two species of trout, the common brown trout and the rainbow trout, both sporting fish and excellent on the table. A small hatchery can be erected near the spot chosen for the eventual liberation of the fry, and Mr. Francis has offered his services to take charge of the hatchery from the time of the arrival of the ova until the liberation of the fry.

Should the experiment be successful the sport of trout fishing in the hill streams of Vitilevu cannot fail to add to the attractions of the Colony, as has been the case in British East Africa and Ceylon, where trout have been successfully introduced into the hill streams and have thrived.

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EDITORIAL NOTES—AUGUST, 1920.

Considerable interest is being taken at the present time in new sources of food supplies. Trials have been made of mixtures of flour with maize-meal, and samples of bread prepared with this mixture have been received from the Suva Bread Company. The bread which is somewhat heavier than "wholemeal" bread, is of fairly open texture, golden yellow in colour, and was considered to be of excellent flavour. Persons who object to "brown" bread may have similar objections to the maize mixture bread, but no fault could be found with the palatibility of the sample tried, and the nutritive value is beyond question. Difficulty has been experienced in grinding maize-meal in small quantities by hand machines, but this will disappear soon, since machinery is being installed at Sigatoka for producing maize-meal on a large scale. The Nadroga Produce Company is installing at Vunisalu a grinding plant consisting of a Simon flour roller mill with four rollers, 16 in. long by 7 in. diameter, together with the necessary dressing and grading machines. This is turned by an 11 H.P. internal combustion engine. This new industry offers a suitable means for using in the Colony one of our most easily produced crops and should enable a considerable sum of money now sent abroad for the purchase of foreign food-stuffs to be retained in the Colony, thus helping to make the Colony less dependent on such foreign supplies. The advantage to the Colony in a locally-produced food-stuff in the elimination of interference with supplies by maritime strikes or by shortages abroad is considerable. The success of any undertaking of this kind depends upon the demand which exists or can be created. It is to be hoped that the good qualities of the food product turned out will be realised by all classes in the Colony, as they are recognised in many countries in the world. The time seems most opportune since the use of this new food-stuff, which can be sold at a moderate price, may at first be a necessity in view of the high price of the usual food-stuffs and subsequently become a habit.

Four tons of Sea Island Cotton seed have been secured in the West Indies for early shipment to Fiji. The seed has all been allotted. While the crop is recommended only for cultivation in the dryer parts of the group, it may be mentioned that even the wet districts at one time were largely under cotton. The results in these latter districts are more problematical on account of suitable weather being less certain during the picking season. Applications have been received for seed from

persons intending to try the crop within these areas, and while there is no objection to this it is recommended that such trial plots should not be more than an acre or so in extent.

Since Lieut.-Col. J. W. Rainey, C.B.E., M.R.C.V.S., will have left the service of this Government before the next issue of this Circular, we take this opportunity of expressing our regret that Col. Rainey should have found it necessary to take this step, which we feel sure will be shared by all who are interested in matters connected with stock, particularly by those who are personally acquainted with this officer. The Colony has been fortunate in having the services of an officer of the eminence in his profession of Col. Rainey, even for so short a period as one year, during which all the agricultural centres of Viti Levu except Ra and of Taviuni have been visited, and the work done will form a basis for continuation of veterinary work in a proper manner.

the corms in the various plantations can be traced to one or two original plantations. I have been informed by growers that the Bunchy Top condition is occasionally found in Fiji and in the New Hebrides. As far as their observations went it was confined to plants whose roots had been affected by an excessive amount of water.

"In one case I observed at Teranora the disease appeared to be directly connected with a water soakage and to be spreading in the direction of the water flow; in another case it appeared to be most prevalent in the dampest part of the orchard. On the other hand, a grower showed me a plant which had had Bunchy Top for years while no plants in the vicinity showed the disease; while at the plantation of another grower bananas had been grown for ten years or more and had only just begun to show Bunchy Top. These are only a few observations among a number that strengthen my view that Bunchy Top is in the main due to faulty root development or root decay, and is not a contagious disease. Roots upon corms growing upon three types of soil: (*a*) chocolate soil, old cane land, very deep; (*b*) virgin scrub land, chocolate soil not very deep; (*c*) soil intermediate in character between that found on typical scrub land and typical forest land, all showed dying at the tips, and decay more or less extensive, travelling from the apex towards the corm, and the plants from which they arose all showed Bunchy Top. On the other hand, roots from plants growing from healthy plants in a somewhat sandy soil near the sea where the rainfall was fairly regular showed no decay; they extended for several feet, and were fleshy and turgid.

"We may conclude, therefore, that either the physical or chemical condition of the soil has contributed to the decay of the roots, or the atmospheric conditions to which it has been subjected. These latter we cannot control. A comparison may therefore be made of soil in which healthy banana plants are growing and of soil in which banana plants have developed Bunchy Top, with a view to applying remedial measures.

The Soil Conditions.

'Three samples of soil were submitted to Mr. F. B. Guthrie, F.I.C., Chemist, for analysis—Nos. 1 and 2 from the neighbourhood of a plant that had developed Bunchy Top and No. 3 from a plantation in which no plants had developed Bunchy Top. The points upon which an expression of opinion was asked from Mr. Guthrie, and the answers received from him, were as follows:—

"*Question* 1.—Is the physical condition of soils 1 and 2 sufficiently different from 3 to suggest that the sandy nature of the latter is responsible for the non-development of root-rot following water-logging?

"*Answer.*—Soil No. 3 is very much more sandy than Nos. 1 and 2, which are almost pure clay. Its capillarity is higher and its water-holding power less, so that it is less likely to become water-logged and would more readily recover from such conditions than the others. At the same time it is curious that No. 3 is more acid in reaction, a state of things usually associated with accumulation of water. This soil would probably be readily sweetened by the addition of lime, whereas the other requires draining.

"*Question* 2.—Is there much more salt in No. 3 than in Nos. 1 and 2? (These two samples were taken from the same spot at different depths.)

"*Answer.*—Salt is absent in all cases.

"*Question* 3.—Would lime be of benefit to the soil? If so, should calcium oxide or calcium carbonate be added? The soil does not appear to be rich in humus and is porous to a considerable depth.

"*Answer.*—Lime would benefit in all cases. In the case of Nos. 1 and 2 freshly slaked stone lime should be used to break up the heavy clay, ½ ton per acre. In the case of No. 3, carbonate of lime or agricultural lime at the rate of one ton per acre will be more effective.

"*Question.*—4.—Are these soils, or Tweed River district soils in general, deficient in some constituent that could with advantage be supplied by an artificial fertiliser? As bananas are supposed to do better by the sea, some local growers suggest the application of salt.

"*Answer.*—These soils are rich in nitrogen and lime, and rather poorly supplied with phosphates and potash. The soils from the Tweed River are on the whole rather above the average in plant food.

"*Question* 5.—What general manure should be recommended for banana plantations in the Tweed River district? Soils on the Tweed River hillsides suitable for growing bananas are divided locally into 'scrub land' and 'forest land.' The scrub land consists of deep, porous, chocolate-coloured soil, and, if very deep, appears to be capable of growing bananas for ten years or more. The forest land is of a much lighter colour, contains more clay, and the bananas do not appear to thrive on it for more than four years neither do they on the chocolate soil if it is not deep.

"*Answer.*—The mixture for bananas on these soils should be well supplied with potash and phosphates, in both of which the soils are rather lacking, and both of which, especially potash salts, are essential in banana growing. I should be inclined to attribute the abnormal growth observed (in the absence of any fungus or other disease) to the extreme stiffness of the soil, which hinders the free development of the root system and thus affects the growth of the plant. The remedy in this case would be to plough up well and subdrain and to apply plenty of freshly slaked lime. The application of salt might be tried as a experiment.*

"The replies of the Chemist indicate in what direction aid from artificial fertilisation may be expected; below are the combinations of artificial fertilisers recommended by Mr. Guthrie:—

"4¼ cwt. Superphosphate
"1½ ,, Sulphate of potash
"3 ,, Dried blood (*or*) 2 cwt. Sulphate of ammonia } per acre.

"Different quantities of these proportions might be tried:—

"6¼ cwt. Superphosphate
"2¼ ,, Sulphate of potash } per acre.
"4½ ,, Dried blood

Or,

"8½ cwt. Superphosphate
"3 ,, Sulphate of potash } per acre.
"6 ,, Dried blood

"These formulæ are affected by the failure of supplies of sulphate of potash and it will be necessary, Mr. Guthrie adds, to apply the potash separately. Make up the mixture as to the other items, but apply the potash in the form

* The configuration of the land and the large number of surface boulders would, in the majority of cases, render ploughing or subdraining impossible.

"BUNCHY TOP" OF BANANAS IN THE TWEED RIVER DISTRICT.

The following articles by G. P. Darnell-Smith, D.Sc., F.I.C., F.C.S., Biologist, N.S.W., Department of Agriculture, appear in the *Agricultural Gazette of N.S.W.*, the first one in the issue of November, 1919, and the second one in the August, 1920 number. As the disease exists in Fiji, as is mentioned in the former article, the reports of Dr. Darnell-Smith's investigations will be of great interest to banana growers in Fiji.:—

Article of November, 1919.

"In accordance with a request from the Fruitgrowers' Association, I lately visited the Tweed River district, in company with Mr. Hopkins, to investigate the disease known as 'Bunchy Top' in bananas. The plantations of a number of growers were visited and inspected, and I have to thank these gentlemen for help and hospitality, and especially to mention Mr. Stewart, Secretary of the Fruitgrowers' Association, who rendered much help. Numerous banana plants were dug up and examined, specimens were examined macroscopically and microscopically on the spot, and numerous specimens were preserved for further examination in the laboratory.

"A detailed examination of these latter, subsequently made by Mr. C. O. Hamblin, B.Sc., B.Sc.Agr., Assistant Biologist, by means of several series of microscopical sections, failed to reveal either fungus or bacterial disease as the cause of Bunchy Top. In many diseased plants numerous eelworms (two species) were found in the roots, but in many diseased plants the eelworms were not present in great numbers, and in some apparently healthy plants eelworms were present. There is no evidence that eelworms exude a toxin hurtful to the whole plant, and in many cases they did not appear to be present in sufficient numbers to cause a disease. A review of the whole situation, after examining all the material at my disposal, leads me to the conclusion that Bunchy Top is not due to a fungus, to bacteria, or to eelworms. There remains the alternative conclusion that it is due to some physiological condition, to some unhealthy state of the plant brought about by adverse conditions of soil or climate, or by a 'running out' of the stock. In considering this aspect we may inquire, first, briefly, what are the conditions of growth in a healthy banana plant?

"1. The fleshy roots extend several feet all round the corm, absorbing, by their root hairs, the necessary mineral constituents from the soil.

"2. The leaves expand and in sunlight manufacture the necessary sugar and starch, at the expense of which, combined with the necessary mineral constituents, the whole plant including the corm, grows.

"3. When the food supply derived from sources 1 and 2 is adequate, new tissue is continually formed, fresh leaves unfold, the small cap covering each of the young ones remaining intact until they are sufficiently developed to suffer no damage from rain; the false stem formed from the sheathing leaf stalks increases in size, and so does the corm. This latter at length sends up an apical growth, bearing a bunch of bananas, through the centre of the false stem (formed by the sheathing stalks of the leaves), and at the summit the banana bunch emerges, gradually becoming pendulous.

"We may now consider the chief symptoms of Bunchy Top in plants affected by the disease:—

"1. As its name implies, the most characteristic feature of the disease is the tendency for the leaves to remain close together instead of expanding normally; hence such names as Bunchy Top or Cabbage Top.

"2. The laminæ and stalks of the leaves are extremely brittle, and the laminæ of the leaves will frequently break sharply across if squeezed in the hand.

"3. The cap protecting the young leaves falls off before they have properly developed. This results in secondary symptoms. Rain enters the leaf scroll, and the water remaining stagnant at the base decay is set up in the centre of the stem. This may reach varying degrees, from little rust-coloured areas to the offensive putrefaction of the whole of the interior of the stem.

"4. At the base of the upper leaf stalks in affected plants, parallel dark-green lines are visible. These were first pointed out to me by Mr. Marks, junr. They seem to be invariably present. No organism has been found connected with these lines, and no marked alteration in internal structure. A number of the cells, however, have considerable deposits of gum in them. The dark lines are probably indicative of an unhealthy condition. In diseased plants a bunch of bananas is either not developed at all, or if it is, the bananas are small and puny, and the bunch often fails to assume the pendulous position. If the bunch does completely emerge and hang down, (*a*) the large bracts at the apex are often greenish-red instead of red and have a tendency to curl; (*b*) the bananas are black at their apices (anthracnose).

"5. The stems of young corms are often somewhat constricted near the apex, while the leaf laminæ are somewhat broad, in contrast to the stems of young corms on healthy plants, which taper gradually to the apex, while the leaf laminæ are somewhat ribbon-like.

"6. The roots upon the corms of all diseased plants that were dug up were invariably found to be in an unhealthy condition. Instead of being several feet long, fleshy, and turgid, their extremities were dead. Sometimes they were decayed over half their length; sometimes the decay extended as far as the corm, in which case the external coating of the corm was blackened. In some roots numerous eelworms were found, but sections through these roots at the point of junction of the healthy and unhealthy portions fail to demonstrate that the decay is entirely or in large part due to eelworms, bacteria, or fungus disease.

"The cause of Bunchy Top appears to be in the main due to this root decay, and the indications are that it has been brought about by adverse conditions, drought or flood, or drought followed by flood. I understand that in the Tweed River district there have been practically two droughts followed by floods in the last two seasons. There are two reasons why bananas should here show themselves particularly sensitive to adverse climatic conditions. (*a*) The banana is naturally a tropical plant, and in the Tweed River district it is growing practically at its southernmost limit. (*b*) The bananas in the district would naturally show a tendency to 'run out,' since bananas are not produced from seed and, so far as I could gather, all

"A bunchy top plant must therefore be regarded as possibly infectious, and the object of the present note is to inform growers of the advisability of destroying bunchy top plants completely (to dig them out and leave them on the ground is of no advantage), and to keep one set of tools for dealing with affected plants and to use them for no other purpose.

"That any organism is the actual cause of a disease can only be demonstrated by a series of infection experiments carefully carried out, and these take time, but in the meantime (additional to the foregoing precautions) strict attention to the selection of healthy suckers from healthy stock, and the rejection of those showing internal signs of disease (the red threads can be seen where the sucker has been detached from the plant corm) is recommended as the surest method of eliminating bunchy top.

"As still further precautions, the cut end of suckers should be dipped in lime before being planted, and places from which bunchy top plants have been removed should have lime dug into them, and new plants should not be set in such spots for a considerable period."

EXTRACTS FROM REPORTS OF INSPECTORS.

COCONUT SCALE.

Mr. M. A. Forsyth, Levuka, reports that at Wakaya scale still appears in isolated areas, and it is immediately dealt with by cutting and burning. Numbers of unhealthy looking coconut leaves from these islands have been sent in by planters and brought by masters of cutters from Koro, Nairai and Lau, and so far none have been found to be infested with scale.

On Ovalau the cultivations of the native towns around the coast have been inspected, and most of them were found to be practically free from scale. The conditions at Moturiki and at the large plantations on Ovalau have not materially altered since the conviction as reported last month.

BANANA SCALE.

Mr. H. V. G. Rivington reports on a visit to the Upper Rewa that riding from Vunidawa as far as Wailevu on the Wainibuka and Nubumakita on the Wainimala he saw no signs of Noogoora Burr, both of the roads followed being those along which cattle have been travelling from the north of the island.

The cultivations of five native towns on the Wainibuka from the junction with the Wainimala up to Wailevu were inspected. The bananas were practically free from live scale, although on the dead leaves in some cases much dead scale was found.

The cultivations of certain Indians between Vunidawa and the Wainibuka were inspected. No live scale was found.

From Vunidawa to Wairuarua the cultivations of four native towns were inspected. The bananas were found to be practically free from scale. Fruit was more plentiful than on the Wainibuka and for the time of the year the banana plants looked remarkably well. No banana cultivations were met with between Wairuarua and Nubumakita.

Four European banana plantations and one worked by Chinamen were inspected. The bananas are practically free from scale. In one case the plants seemed to be suffering from the dry weather.

INSPECTION OF FRUIT.

The Inspector of Produce reports that the s.s. "Atua" sailed for New Zealand on 6th August and took 307 bunches and 15,206 cases of bananas, equivalent to a total of 30,719 bunches. The quality of the fruit was better than during the last three months. Rejections amounted to 8·4 per cent. of the shipment. Again the shipping company asked to have a number of cases inspected and stacked on the wharf for night loading, and with the concurrence of shippers this was agreed to in order to expedite the loading. The late running of the steamer delayed loading one day. All the cases were clean and well nailed, ample dunnage was provided and ventilation was good. The fruit was carefully handled and stowed. A feature of the shipment was the scarcity of ripe fruit, and particularly in view of the fact that the late sailing of the steamer gave the fruit an extra day between cutting and shipment. Loose packing of the cases was in evidence. Every punt was examined carefully for signs of fumigation. Very little scale was observed and no live scale was met with. This vessel also took 481 sacks of maize, which had been fumigated for at least 12 hours, and 169 sacks and

of wood-ashes two or three weeks previously. Roughly, 13 or 14 cwt. of wood-ashes will be required for each 1 cwt. of sulphate of potash.

"It is interesting to note that in reply to numerous inquiries among growers as to whether anyone has succeeded in arresting Bunchy Top, the only one who thought he had had some indications of success was Mr. Marks, junr. He had applied lime directly to the corms and around them with the view of neutralising an acid produced, as he thought, by worms. The production of the acid by worms may be doubted, but of the amelioration of the soil by the application of lime there can be no doubt.

The Treatment of the Plants.

"We turn now to a consideration of what may be done to combat the disease by treatment of the plants themselves. Suckers should be taken for fresh plantations only from plants which are perfectly healthy and which have shown no signs of Bunchy Top. Whatever may be the cause of this disease, the tendency to form Bunchy Top may become hereditary. Our cauliflowers, which we prize to-day, are nothing less than botanical monstrosities, only in this case it has suited us to propagate the abnormal plants. A good banana sucker should have a firm corm, a tapering stem (without any sign of constriction), and ribbon-like leaves. In Jamaica the life of a banana plantation is reckoned at five years; in the Tweed River district they have lasted much longer, but there appears to be a tendency to grow too many stems on one clump. I may quote here from Fawcett's book on the banana. 'There is no part of banana cultivation that needs as much individual attention, supervision and judgment, as the pruning. The retaining of wormy suckers may mean the loss of hundreds of pounds to the large cultivator. If the planter is fortunate in growing a fairly even field of plants, then all is plain sailing, as one size of follower* may be left throughout the field, but, otherwise, then each sucker must be treated on its own merits. I have observed more mistakes in pruning, entailing more or less loss to the owner, than I care to recollect; some from ignorance, but more often from greed. It is hardly possible to grow more than 450 stems per acre and get your followers *right*. Some persons try to get as many as 600 to 700. These speculators usually wind up by marketing not more than 200, and most of these in the bad months.'

"It is curious that Bunchy Top has been observed in sugar cane. In reply to inquiries, Mr. Ward, of the Botanic Gardens, informs me that something similar to Bunchy Top has been observed in cannas, and he thinks it would be possible to produce Bunchy Top by treating the parts of the plant below ground in an unsuitable manner. That Bunchy Top should occur in plants so widely separated botanically as the sugar cane and the banana, indicates that the disease is of physiological origin, for a fungus disease usually confines its attacks to plants that are closely related.

"Different manners of treating stems from which a bunch of bananas had been removed were noted. Sometimes they were left, sometimes they were cut in half, sometimes they were cut near the base. I am of opinion that as soon as the foliage leaves have withered the old stems should be removed completely from the plant and left to rot at some distance from it, in order that water may not collect above the corm, and that the mucilaginous slime incidental to decay may not fall directly upon the parent stock.

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* A "follower" is a sucker left at the root of the parent plant to produce the succeeding crop.

"In order that the banana industry in the Tweed River district be put on a better footing I would recommend:—

"1. That fresh stock from a more tropical district be imported under suitable supervision to replace the present stock, which may be running out. The variety grown is almost exclusively that known as the Cavendish.

"2. That a man versed in tropical agriculture travel the district to advise growers.

"3. That a small banana plantation in the district be acquired by the Government for experimental purposes.

"4. That the Tweed River Fruitgrowers' Association experiment on some plantation, not too old, which has shown indications of developing Bunchy Top, by applying such manurial dressings as have already been indicated, plots, say, of one-tenth acre being tried, leaving check plots at intervals."

ARTICLE OF AUGUST, 1920.

"The external signs of 'bunchy top' are well known, but it may be advisable to call attention to some internal signs.

"Healthy banana tissue, both of the corm and of the pseudo-stem is almost dead white when first cut across. It may, of course, turn to purplish colour on the outside soon after it has been cut with a steel knife, owing to the action of tannin and the formation of a sort of ink.

"The unhealthy tissue of a bunchy top corm is pink or reddish-brown. In bananas in the incipient stages of the disease in the lower part of the corm, irregular threads, yellowish-red or light-brown in colour, are seen. In more advanced stages of the disease these threads are darker and reach the base of the pseudo-stem, and they may run up the stem for a considerable distance.

"From these unhealthy corms, cultures of bacteria have been obtained under suitable conditions, which form white, circular, moist, glistening colonies. These colonies must consequently be regarded with suspicion.

"Growers are recommended, therefore:—

"1. Not to plant any bulbs showing the internal symptoms referred to.

"2. To dig out and *destroy completely* all bunchy top plants.

"To keep one set of tools for dealing with bunchy top plants, and to use them for no other purposes.

"Colonies of bacteria somewhat similar to those from banana corms have been obtained from the roots of sugar cane showing signs of bunchy top.

"The reddish sap that collects in the hollowed out rhizome of a bunchy top plant has been found to have an extraordinarily rapid withering effect upon young shoots placed in it.

"The presence of the reddish threads (diseased vascular bundles) is not peculiar to the bunchy top disease; they are found in other banana diseases, including the Panama disease. Dr. Brandes has given a very detailed account of Panama disease in *Phytopathology*, vol. 9, No. 9. Several of the symptoms of this disease are found upon bunchy top plants. The Cavendish banana is not supposed to be susceptible to the disease, which is caused by a fungus, *Fusarium cubense*. A *Fusarium* fungus has occasionally been found upon bunchy top plants.

LIBERATION OF COCONUT SCALE PARASITES.

By H. W. Simmonds, F.E.S.

The two scale-infested palms which had been placed in contact for the past five weeks with those imported from Tahiti in order to allow the parasites in the latter to transfer themselves to the new material had shown a certain number of the larger yellow Chalicid running about on their leaves, and it was therefore decided that it was now time to remove them to one of the badly-infected areas on Ovalau.

It had been necessary to transfer the parasite to local material in order to prevent the possibility of introducing any fresh disease from the Tahiti group, whilst the local trees were again before moving most carefully examined for any possible trouble other than the scale *Aspidiotus destructor* which might be upon them.

I according leftly by the "Adi Keva" on the 8th September with the palms, arribing at Levuka next day. Hence, in company with Mr. M. A. Forsyth, we carried them to Bureta on the other side of the island where they were placed in close contact with badly-infested material in the neighbourhood of the village, where I trust the parasite will succeed in establishing itself.

Coconuts in the neighbourhood of Levuka looked well, but were not bearing heavily; in fact, nowhere did I see a tree that would compare in yield with those observed in Tahiti.

As we proceeded along the coast evidence of recent scale was observed, and many of the trees had had numbers of their leaves cut off under Mr. Forsyth's instructions with apparently successful results. On the other side of the island however this had not been nearly so successful and almost every tree had become reinfected. Further, since bananas and native trees and even the guava acted as host plants, I do not think that cutting out can ever in itself clean up the disease, since this cannot be done continuously whilst of course it throws the trees back badly in their bearing.

In a young plantation I noticed signs of old scale, but none was then present. This may have been due to ladybirds or lacewing flies.

Careful examination of a number of badly-infected trees failed to show any enemies at work except an example of the ladybird *Anisorcus affinis*. Night search was also made with negative results.

I regret to see that the curse *Clidemia hirta* has obtained a strong hold on this side of the island and unless eradicated will doubtless soon spread over the rest of the country.

A fan palm in the hospital grounds at Levuka was very badly attacked by fungus *Graphiola phœnicis* (kindly identified by the Superintendent of Agriculture). Coconut palms in the Rewa seemed to be as heavily attacked as ever by *Levuana iridescens*.

CASSAVA AS A SOURCE OF INDUSTRIAL STARCH AND ALCOHOL.

The following extract is taken from an article in the *Bulletin of the Imperial Institute*, Vol. XVII, No. 4, October—November, 1919. Its interest lies in the fact that cassava thrives very well in Fiji, while it is perhaps the cheapest source of starch, and therefore, probably comes next to molasses as a raw material for the production of commercial alcohol:—

Alcohol from Cassava.

"The shortage of petrol brought about by the war has had the effect of stimulating attempts in several countries to produce alcohol from a variety of saccharine and starchy vegetable materials, for use in internal-combustion engines, both for purposes of transport and for agricultural machinery.

"Reference has already been made in this *Bulletin* (1915, **13**, 604) to the use of cassava for this purpose. As a source of alcohol, one ton of cassava roots would in practice probably yield from 30 to 35 gallons of 95 per cent. spirit; one ton of potatoes yields about 20 to 24 tons gallons, and one ton of cereal grain about 40 to 60 gallons of 95 per cent. spirit.

"As it appears very probable, from the experience gained during the war, that alcohol will remain a competitor with petrol as a source of mechanical energy, the following notes on the use of alcohol in internal-combustion engines will be of interest.

"In consequence of the fact that alcohol is less volatile than petrol it has generally been found necessary to add to the alcohol a certain proportion of more volatile material in order to enable it to be used in engines constructed to work with petrol. Thus in Natal a mixture containing 60 per cent. of alcohol and 39 per cent. of ether, with small quantities of arsenious acid and ammonia gas, has been patented for use as a motor fuel under the name 'Natalite.' One advantage of using ether for this purpose is that it is itself easily manufactured from alcohol.

"A mixture of 20 gallons of 95 per cent. alcohol with 5 gallons of benzol to which 8 ozs. of naphthalene have been added is stated to work quite satisfactorily in petrol engines, with no alteration except to the carburettor."

SCALE OF FEES FOR THE ANALYSES OF SAMPLES.

His Excellency the Governor directs the publication, for general information, of the following scale of fees for the examination of samples sent to the Government Chemist by private persons.

2. This scale of fees replaces those published at page 551 of the *Royal Gazette* for 1914 and at pages 514 and 515 of the *Royal Gazette* for 1915.

3. All fees are payable in advance and will be received by the Superintendent of Agriculture or the Government Chemist, by whom they will be paid into General Revenue.

4. Analyses of soils, feeding-stuffs, &c., of general interest to the agricultural community will be analysed free of charge as heretofore, and the results of these analyses will be published by the Department of Agriculture for general information. But if fees have been paid for analyses, the results

10 cases of kumalas, there being apparently a ready market for this product in Auckland. Ten sacks of taro were also shipped.

The s.s. "Levuka" took 4,717 bunches and 2,137 cases to Sydney, and 7,846 bunches and 6,047 cases to Melbourne, equivalent to a total of 28,931 bunches of bananas. Rejections amounted to 7·2 per cent. of the shipment. A quantity of immature fruit was noticed in most punts, and numbers of cases had to be repacked for containing immature fingers. One particular line contained much ripe fruit and in general this fruit had a somewhat stale appearance. A thorough search was made for scale and very little was met with. Each shipper produced a written statement that his fuit had been properly fumigated. These statements were endorsed by the Inspector after satisfying himself that evidences of fumigation existed in each punt. These statements were subsequently forwarded to Australia attached to the certificate issued by the Inspector of Fruit. The Sigatoka fruit was, as in previous shipments, again well ahead in quality of the rest of the fruit shipped. At commencement of loading the temperature of the cold air supply was 19°F. The fruit was carefully handled and stowed, and ample dunnage was provided and used.

INSPECTION OF VESSELS.

The following list shows the number of vessels inspected during the month of August under the Diseases of Plants Ordinance 1913 Regulations, and the number of cases in which material was destroyed:—

Port.	*No. of vessels inspected.*	*Cases in which material was destroyed.*
Suva	11	1
Levuka	69	18
Lautoka	5	—

DEPARTMENTAL NOTES.

Mr. H. V. G. Rivington left for Ba on 7th September where he will carry out inspections under the Noogoora Burr Ordinance.

Mr. H. W. Simmonds has proceeded to Levuka, taking certain coconut palms affected with parasitised scale brought from Tahiti. A note on this by Mr. Simmonds appears in this issue.

A pamphlet on the ciultvation of Sea Island Cotton is in course of preparation. Copies will be sent to applicants for cotton seed, and the Superintendent of Agriculture will be glad to hear from other interested persons who may desire copies.

ULCERATING TUMOURS OF THE LEGS AND EYES OF HORSES, AND THE BACK AND EYES OF CATTLE.

By J. Wakefield Rainey, Government Veterinary Officer.

Synonyms: Fiji Sores; Fiji Disease.

Investigation of this group of diseases has occupied considerable time and thought, and it is only on the eve of my departure from Fiji that I am able to give a clear account of the cause and treatment so far as the tumours affecting horses are concerned and to suggest the lines of investigation on which work should proceed similarly to define the causation and treatment of the tumours affecting cattle.

Horses.

The tumours are found in horses chiefly in the region of the fetlock and coronets and in the tissues of the orbit. They are due to the presence in the tissues of the embryos of a filarial or "thread" worm.

The filaria probably gain access to the tissues when the continuity of the skin is broken by a wound or "grease," or by grass seeds. Once lodged in the subcutaneous tissues they excite an inflammation of a local nature with the consequent formation of dense fibrous and vascular tissue which assumes the appearance of an ulcerating and projecting "sore."

Treatment should be directed to the destruction and removal of the filaria either by means of operation or by daily dressing with a strong preparation of sulphate of copper. A good mixture is made by pounding together in a mortar one part of sulphate of copper wth two parts each of lead acetate and zinc sulphate until a paste is formed. A combination of operation and dressing with the above described caustic paste gives the best results.

Cattle.

The tumours found affecting the backs of cattle seem to be due chiefly to the intense action of rain and sunshine on light-coloured devitalised skin. Black or dark-skinned animals are not affected. The treatment should be excision of the tumours followed by daily dressing with a dense black ointment, made by mixing lamp-black charcoal with soft and hard paraffin or lard and bees-wax to which a little creasote and camphor are added to keep off flies.

The cause of the tumours affecting the eyes of cattle is not yet established; it may be a filarial worm.

The treatment should be early excision and quick fattening for the butcher.

of these analyses will be regarded as confidential and will not be published by the Department of Agriculture.

SCALE OF FEES.

	£	s.	d.
Soils.			
1. Determination of one constituent only	0	10	6
2. Mechanical analysis of a soil	2	2	0
3. Chemical analysis of a soil	2	2	0
Manures and Fertilisers.			
4. Fertiliser containing either nitrogen, phosphoric acid, or potash	1	1	0
5. Mixed manure	2	2	0
Feeding-stuffs.			
6. Determination of one constituent only	0	10	6
7. Commercial analysis of oil-cake or other feeding-stuffs	2	2	0
Copra.			
8. Determination of moisture	0	5	0
9. Determination of oil	0	10	6
10. Commercial analysis of copra	1	1	0
Limes and Limestones.			
11. Determination of calcium oxide or calcium carbonate	0	10	6
12. General chemical analysis of a lime or limestone	2	2	0
Waters.			
13. Quantitative analysis with an opinion as to fitness for drinking purposes	1	1	0
14. Examination of distilled water for accumulators	0	10	6
Food and Drink.			
15. Coffee, cocoa, mustard, ginger, butter, ghee, cheese, condensed milk, &c.	2	2	0
16. Olive oil, mustard oil, or other vegetable or animal oil	2	2	0
17. Wine, beer, or other liquor for percentage of proof spirit	0	10	6
18. Hydrometer strength of whisky, brandy, or other spirit	0	5	0
19. Obscured strength of whisky, brandy, &c.	0	15	0
20. Determination of total solids and fat in milk	0	5	0
Drugs.			
21. Determination of one inorganic constituent	0	10	6
22. Analysis of an inorganic drug	1	1	0
23. Determination of morphine or other alkaloid in a drug	1	1	0
Minerals.			
24. Qualitative analysis of a mineral, rock, or ore	0	5	0

Fees for the analysis of other samples, if accepted for analysis, will be fixed according to the amount of work involved in the analysis.

Agricultural Associations in Fiji.

THE COUNCIL OF PLANTERS OF FIJI.

Chairman.....MR. J. L. HUNT.

Vice-Chairman.....MR. E. DUNCAN.

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THE CAKAUDROVE COPRA GROWERS' ASSOCIATION.

THE CANE GROWERS' ASSOCIATION OF FIJI (BA AND NADI BRANCHES.)

THE LABASA PLANTERS' ASSOCIATION.

THE SAVUSAVU PLANTERS' ASSOCIATION.

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